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RESULTS OF THE CONFERENCE ON WELDING OPERATIONS IN THE SOVIET AVIATION INDUSTRY

Engr G. A. Maslov, NIAT

In mid-December 1947, a seminar conference on the improvement of welding-operations technology was held at the Scientific-Research Institute of Technology and Organization of Production in the Aviation Industry (NIAT).

The conference was attended by technicians from plants under the Ministry of the Aviation Industry (MAP), and by representatives from the Academy of Sciences USSR, Moscow Higher Technical School imeni Bauman (MVTU), NIAT, All-Union Institute of Aviation Materials (VIAM), Central Scientific-Research Institute of Heavy Machine Building (TsNIITMASh), All-Union Scientific Research Institute of Agricultural Machine Building (VISKhOM), Moscow Aviation Institute (MAI), Moscow Aviation-Technological Institute (MATI), and others.

The conference heard 18 reports on various problems in welding technology and the field of welding equipment.

Academician V. P. Nikitin, in his report, "The Development of Scientific and Technical Thought in the Field of Electric Arc Welding," traced the development of the process in the USSR from its discovery in 1802 by physicist V. V. Petrov. He also spoke of a new method of arc welding involving separation of the melting processes of filler metal and base metal, developed in the section on electric welding and electrothermy of the Academy of Sciences USSR.

The problem of the stresses which arise during welding and their effect on the strength of constructions of low-carbon and tempered steels was treated in a report, "The Strength of Welded Constructions," by Professor G. A. Nikolayev, Doctor of Technical Sciences. He stated that efforts to eliminate crack formation must be directed along the line of rational construction of parts and the development of welding methods which will give a tight, uniform seam.

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"Heat Fundamentals in the Welding of Structural Steels," presented by Professor N. N. Rykalin Doctor of Technical Sciences, and "The Determination of Welding Systems for Low-Alloy Steels and 30KhGSA Steel," by L. A. Fridlyand, Candidate of Technical Sciences, were devoted to problems on the theory of heat emission during welding and calculation methods for selecting welding systems. The premises set forth by Rykalin permit establishment of the connection between the characteristics of the welding system and the thermal cycle of heating and cooling of the steel, leads to determination of the structure in the zone of thermal effect and the mechanical properties of the welded joint.

Fridlyand revealed a method for calculating welding systems, which will guarantee a given hardness in the thermal effect zone in both single- and multilayer welding of structural steel.

M. V. Poplavko, Laureate of the Stalin Prize and Candidate of Technical Sciences, in his report, "A New Technology for the Welding and Heat Treatment of Airplane Constructions," told of the work of the VIAM welding laboratory on the utilization of arc and combined welding of units from heat-treated elements with a strength limit of 120-140 kg/sq mm. The process obviates the necessity of heat treatment after welding, considerably simplifying the preparation of a unit and cutting down on rejects. The new method has been adopted at many airplane-construction plants.

The head of the NIAT welding laboratory, Engineer V. V. D'yachenko, speaking on "Welding in an Atmosphere of Argon and Prospects for Its Use in the Aviation Industry," acquainted the conferees with a new method of electric arc welding introduced by the laboratory. Research work on electric arc welding in an argon medium of YalT and YalNb steels was conducted in 1947 by A. Ya. Brodskiy, NIAT senior scientific worker. D'yachenko stated that argon arc welding should be applied in the preparation of manifolds, tanks, and other thin-sheet parts made of stainless steels and heat-resistant steels. In conclusion, the speaker announced that the NIAT laboratory is conducting work on welding aluminum and magnesium alloys in argon.

Professor K. V. Lyubavskiy, Doctor of Technical Sciences, reported on "Some Metallurgical Problems in the Technology of Welding Under Flux." Pointing out that the metallurgical processes which take place under the flux during the welding of low-carbon steels have received insufficient study, the speaker reported on the latest efforts in this field. The reaction of sulfur in the welding bath in connection with crack formation in the seam metal and the effect of surface oxides of the metal on the formation of pores and inclusions in the seam metal have been studied. This is particularly important in solving the problem of welding alloyed steels under flux.

The results of the NIAT welding laboratory's experimental work on the study of the technological properties of electrodes were described by A. A. Yerokhin, Candidate of Technical Sciences, in his report, "The Technological Properties of Electrodes for Electric Arc Welding."

A. G. Mazel', NIAT senior engineer, speaking on "The Fusion Welding of Thin-Sheet Constructions of Heat-Resistant Steels," described the investigation of various forms of fusion welding of YalT and 25-20 steels, 0.5-3.5 mm thick. The speaker reported on the technological peculiarities in the welding of these steels, flux composition, and coatings. In the welding of steels of different thicknesses, it was recommended that for butt joints 1.5 mm or more thick and lap joints 1.2 mm or more thick, electric arc welding be used. Atomic hydrogen welding is recommended for butt joints less than 1.5 mm thick. The speaker considered the use of gas welding as inefficient.

The work of the VIAM welding laboratory on welding heat-resistant steels was reported by Engineer M. A. Lyustrov in "Welding Heat-Resistant Steels and Alloys." Research resulted in the recommendation of fluxes and coatings for different forms of welding. For the gas welding of YaIT adn 25-20 steels, NZh-8 flux is recommended. NZh-1 coating is recommended for the arc welding of EI401, EI403, EI435, and 25-20 steels and alloys.

Problems of the resistance welding of special steels were dealt with by F. I. Kislyuk, Candidate of Technical Sciences, in his report, "Spot and Roller Welding of Stainless and Heat-Resistant Steels and Alloys." The report considers the theory of contact resistance during welding and calculation of the welding current value relative to the physical constants of the material being welded.

The speaker suggested new types of interrupeters for the spot and roller welding of heat-resistant steels and recommended welding systems for 18-8 and 25-20 steels.

In a report, "The Stability of the Process of Resistance Welding of Aluminum Alloys," A. I. Pugachev, VIAM senior engineer, pointed out causes of poor quality and means for eliminating them. Surface preparation with orthophosphoric acid was recommended in particular.

P. G. De-Millo, NIAT senior engineer, spoke on "The Resistance Butt Welding of Aircraft Units." He outlined the existing situation of the use of butt welding in mass production and revealed the results of experimental work on the butt welding of alloyed steels and separate elements of an experimental engine mount.

S. T. Nazarov, Candidate of Technical Sciences, in a report, "Control Methods for Weld Seams," evaluated the methods for control of seam quality used in the aviation industry (X-ray examination and magnetic control). He demonstrated the connection of roentgenogram indexes with the strength of the weld seam and presented a quantitative evaluation of the effect of defects in the weld seam on strength. The speaker revealed a new method for the control of weld seams, using radium gamma rays and requiring a portable apparatus. Nazarov demonstrated the method, using an actual part.

For checking seams in parts which must be airtight, he proposed a method which makes use of chemical reactions and which considerably simplifies the checking process for seams in bulky units.

S. M. Taz'ba, the "Elektrik" Plant's chief designer, reported on "Welding Equipment Produced by Domestic Plants and Equipment Scheduled for Production During 1948 - 1950."

At present, the speaker's plant is producing welding transformers for manual and automatic arc welding (for 100-1,000 a). It is also putting out a 500-cps ac generator for welding thin-sheet parts. The plant has developed and plans to produce automatic machines of new design for welding under flux and atomic hydrogen welding.

Design work is being conducted on new types of resistance welding machines in line with industrial requirements. A number of the machines will be equipped with pneumatic pressure mechanisms and vacuum-tube interrupters.

Reporting on new spot-welding machines used in the aviation industry, B. D. Orlov, NIAT senior engineer, gave a detailed characterization of the machines for welding aluminum alloys and stainless steels -- energy-storing machines.

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G. F. Skakun, MATI engineer, reported on methods for controlling the energy parameters of a welding system with the use of asynchronous and synchronous interrupters and modulators.

S.N. Lotsmanov, VIAM engineer, speaking on "The Hard Soldering of Aviation Materials," reported on soldering methods for aluminum alloys and heat-resistant steels, flux compositions and solder compositions.

A resolution adopted by the conference defines the basic trends for improving the technology of welding operations: the mechanization and automatic control of production processes, finding and introducing new and more satisfactory methods of welding and the control of weld seams, and the development of new types of welding equipment.

The conference recognized the expediency of expanding the production of welding equipment, thyratrons, and ignitrons for the aviation industry at plants under the Ministry of the Electrical Industry.

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